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eAuctions: Impact of Network Externalities on Sellers' Behavior

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ABSTRACT

Virtual markets are becoming more and more accepted by buyers and sellers. The success of eBay has prompted other companies to offer auction sites to lure buyers and sellers. The new companies usually offer lower rates to attract virtual sellers thereby multiplying the number of options for virtual buyers. This project presents an exploratory study of the final value available to sellers on two different auction sites, eBay and Yahoo! Auctions. Specifically, the study aims at finding whether or not the leading Internet auction site provides a better opportunity for sellers to extract more consumer surplus by selling goods for higher prices. The statistical analysis shows that in the leading site (eBay) the number of bids placed is greater, the average final price offered is higher, and the average final value is higher than in the competing site (Yahoo!). These findings are important to virtual sellers and buyers and to new organizations promoting virtual markets.

Keywords

Virtual markets, electronic auctions, network externalities, bidding strategies.

INTRODUCTION

In the last five years, the number of transactions in virtual markets has grown exponentially. eBay, the leader in electronic auctions (e-auctions), has led this new industry to unsuspected success. Many small businesses sell their entire production through eBay. For example, this is the case of many small manufacturers of personal computers. Barke (2004) reports that one PC is sold every ninety seconds and 1900 laptops are sold every day on eBay. Sellers consider that the benefits of selling on eBay surpass the risks of using e-auctions. After ten years of operations, eBay has created a new industry where more than 30 million sellers and buyers exchange merchandise with a value of more than 20 billion dollars annually (Hof, 2003).

The purpose of this exploratory research is to discover if the average final price offered by bidders on auctions appears to be higher on the market leader's site (eBay) than on its competitor site (Yahoo!). Does the market leader's site provide a better chance for sellers to extract more consumer surplus by selling goods for higher prices? Assuming the average final price offered by bidders on the market leader's site is higher, after subtracting the fees charged by the auction sites, will it still be more appealing to sellers than the competitor's site? The answers to these questions are important to virtual market players. Sellers should select the site that gives them higher revenue buyers are better off buying from sites with lower cost and auctioneers should study this behavior to set their fee policies.

In order to fulfill the goals of the study, first we identified a common product to both auction sites and selected the iPOD music player because of its popularity and limited number of models. Second, we collected the results of the e-auctions for two iPOD models during two weeks. Third, we statistically tested the differences between average number of bids, the average final price, and the average final value available to sellers in the site of the leading e-auction company and in the site of its main competitor. The results show that the leader e-auctioneer received higher number of bids, higher average final price, and secured a higher final value to sellers than the competing e-auctioneer.

BACKGROUND

The success of e-auctions has triggered two types of markets. Some companies like Yahoo! have developed their own auction system to compete face-to-face with eBay, while other companies have developed their own market customized for its suppliers or its specific industry. For example, Sun Microsystems created its own virtual market, where suppliers bid for component contracts. Sun's motivation for creating this virtual market was to reduce its procurement cost (London, 2001). Another example of a specialized virtual market is FairMarket Inc. On this site, computer buyers can take advantage of opportunities offered by computer-parts suppliers that want to reduce inventories (Spang, 1998).

Yahoo! and eBay each manage an auction site to support consumer-to-consumer transactions. An auction site is a marketplace which hosts auction transactions for others without possessing or selling any products on its own. Sellers list items for sale on the platform and buyers join by placing bids on particular items they are interested in purchasing. For a seller to list an item on eBay or Yahoo, he or she has to register and create a virtual account by providing personal and credit

card information as the first step. Graph 1 compares the registration process for both sites. Once the seller has an item for sale, he or she determines the item category, title, description, starting price, reserve price, buy it now price/buy price, listing period, payment methods, shipping methods and associated charges: and then the seller upload photos of the item(s) to be sold (Gilkeson and Reynolds, 2003).

After the auction is listed, a buyer can purchase the item at the "buy it now" price if the seller sets such feature, place a bid by using the proxy bidding mechanism of the auction site, or by directly placing a bid on the item of every time he decides on a new price. Using the proxy bidding mechanism, a potential buyer can simply enter the maximum bid amount he is willing to pay for the auction item and let the mechanism place bids on his behalf when his original bid is outbid up until the maximum amount entered by this bidder has been reached. When the auction period ends, the item will be sold to the person who places the highest bid (McDonald and Slawson, 2002.) Graphs 2 and 3 show the flow charts of the transaction process for both sites.

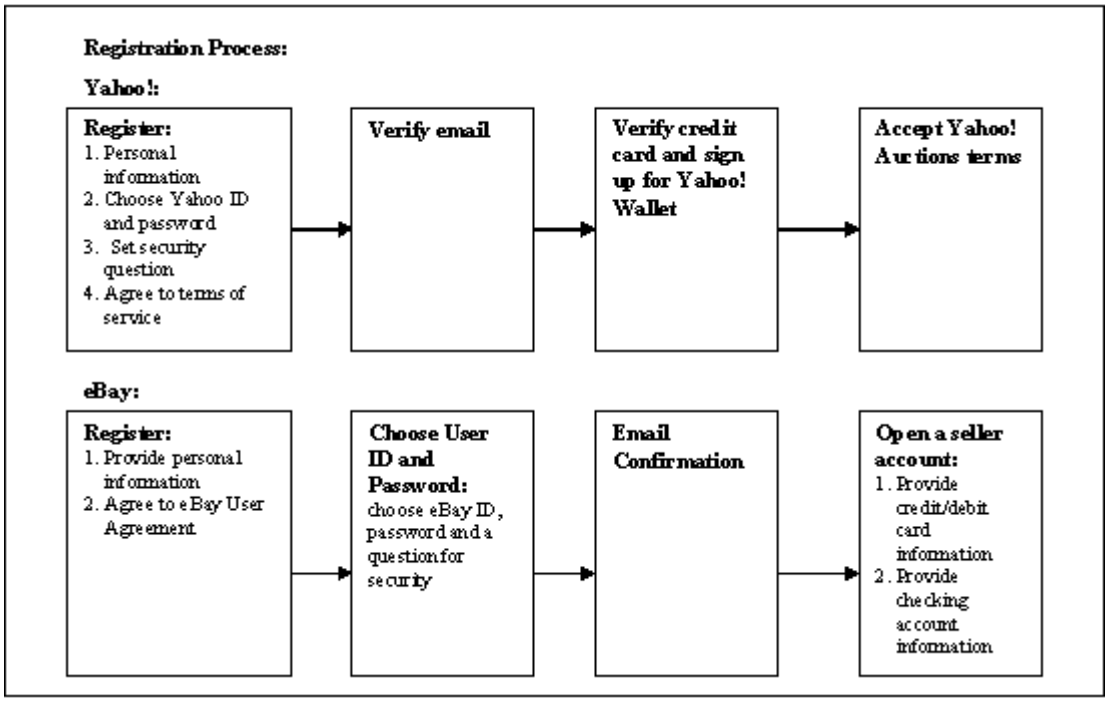

Figure 1. eBay and Yahoo! Registration Process

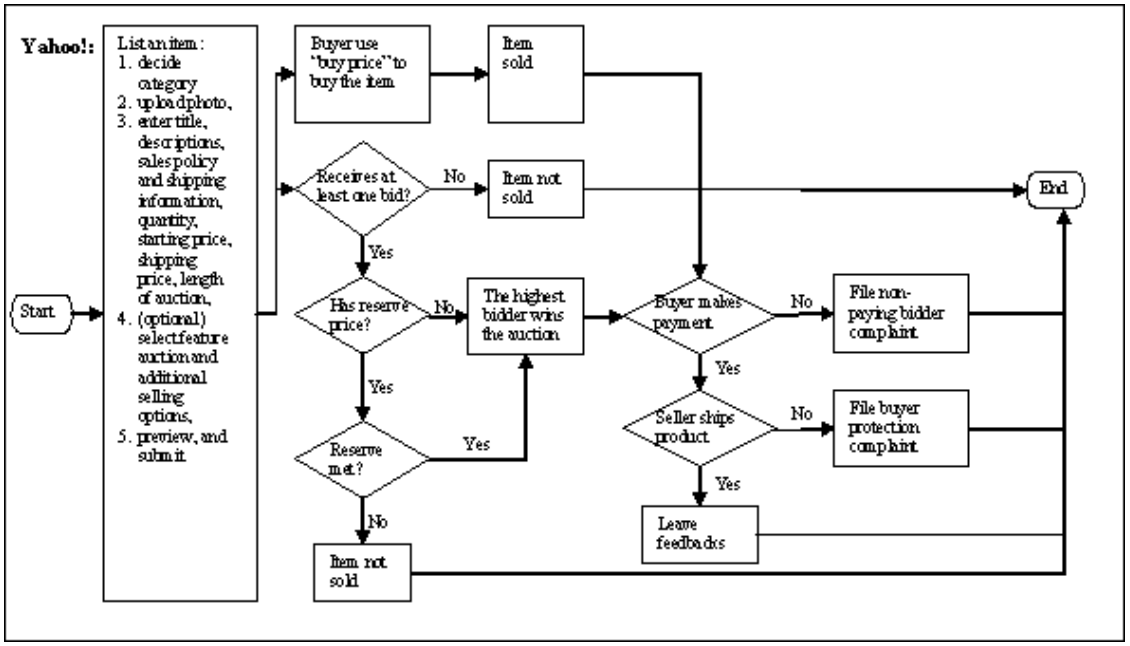

Figure 2. Yahoo!'s Transaction Process

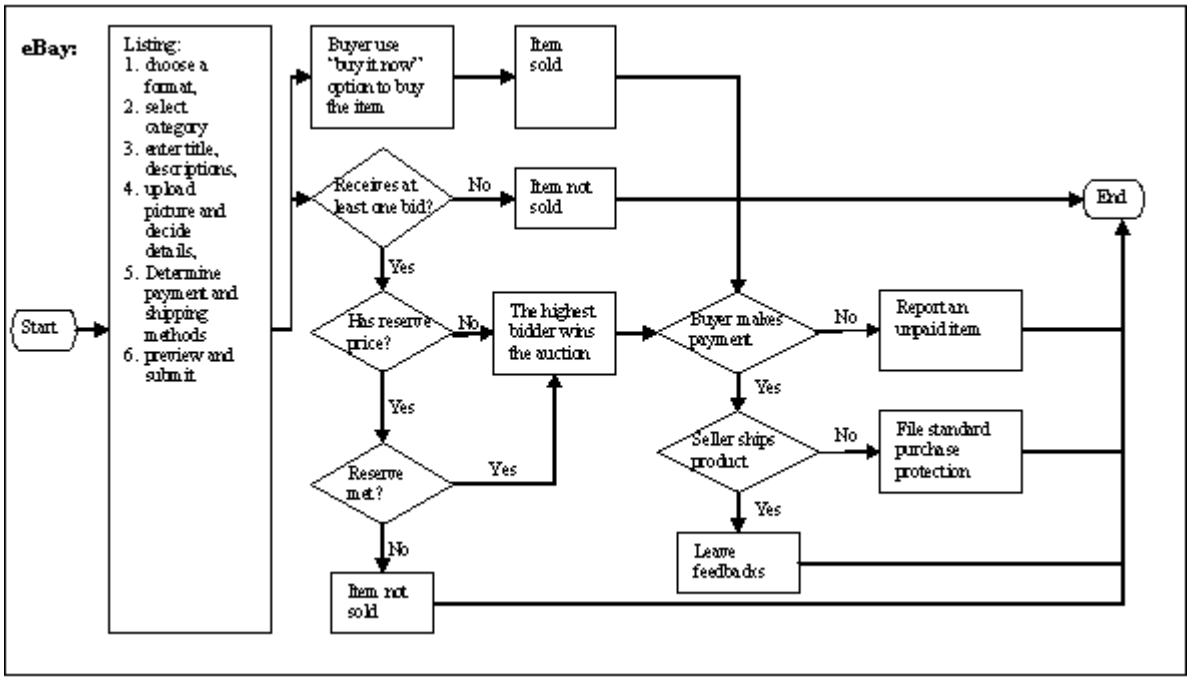

Figure 3. eBay's Transaction Process

The growth of e-auction transactions is stimulating research interest in this area. The challenge for researchers and practitioners is to understand how the many dimensions of factors affect virtual transactions. Scott and Gregg (2004) study the impact of product classification on the output of e-auctions. This research explains why some virtual transactions receive more complains than others. Transactions of products with low complexity and low sensory (i.e. phones and MP3 players) receive less complains than transactions of more complex products such as digital cameras or karaoke players. Vragov (2005) studies the impact of consumer collusion on e-auctions. Consumer collusion reduces sellers' profits. Buyers achieve this consumer collusion through two ways: placing very high bids to discourage other buyers from participating and by placing many very close bids at the end of the auction period. Shang and Ling (2004) worked with data from a Honk Kong auction site (Go2HK) to analyze the impact of network externalities, price level, auction duration, auction context, and buyer types on e-auction.

Network Externality Theory can explain the behavior of different actors competing in a market, where the market-installed base of one player promotes or limits its future market growth. We claim that network externalities affect the behavior of the players in an e-auction market. Brynjolfsson and Kemerer (1996) report that network externalities, among other aspects, affected the prices of microcomputer spreadsheet software. These authors present the impact that the size of the installed base has on the price of the software. For example, a one percent increase in the market size of the product is associated with a 0.75% increase in the product price. Katz and Shapiro (1985) propose a model for markets with consumption externalities. According to this model, consumer expectations have a great impact on markets containing network externalities. The model forecast an equilibrium price in favor of the market leader. Chakravarty (2003), in an experimental setting, studies how two sellers set the price of two competing technologies to two groups of buyers. According to this author, when the market presents strong network externalities, over 80 percent of the buyers select the market's leading product, even though this product has a higher price. The Internet phenomenon and the growth of online business should have an impact on prices. Instant access to virtual markets, prices, and transaction opportunities should push down merchandise prices. However, in the e-auction market the leading site has higher fees than its competitors.

METHODOLOGY

The methodology followed two stages. In the first stage, the study quantitatively tests the relationship between the results of the leading e-auction site and its main competitor for one very popular and standard product. In the second stage, the study qualitatively analyzes the behavior of users of e-auction sites. For the first stage, we selected the iPOD mini and iPOD Photo 40GB because these products were 1) standard and mass-produced items, with no major differences between individual products or sales channel and 2) comparatively popular during the data collection period, with potential to generate enough data for statistic analysis. We excluded the iPOD shuffle, iPOD 20GB, and iPOD Photo 60GB because the data from the Yahoo! site are not large enough to support statistical tests. The auction results analyzed were these: the number of bids

received per listing, the ratio of "listings that received at least one bid" to "total listings," and the average final price offered by the bidders. In addition to these auction results the auction costs were estimated including listing fees and final value fees for both sites. These two components are necessary to analyze the final value in each auction site. The paper addresses the following research questions:

Is the average final price offered by bidders on e-auctions higher on the market leader's site than in the competitor's site?

Does the market leader site provide a better chance for sellers to extract more consumer surplus by selling goods for higher prices?

Specifically, the paper tests the following hypotheses:

H1. The average number of bids placed for the same product on the market leader's site is greater than the average number on the selected competitor's site.

H2. The ratio of "listings that receive at least one bid" to "total listings" is higher on the market leader's site than on the competitor's site.

H3. The average final price offered by the bidders is higher on the market leader's site than on the competitor's site.

H4. After subtracting the fees charged by auction sites, the average final value available to sellers is higher on the market leader's site than on the competitor's site.

The methodology of the first stage of the study consists of three phases: 1) the scope of the project, 2) data collection, and 3) statistical test analysis. In the first phase, we defined the scope of the study, including research companies, geographic area, product selection, and data collection period. In the second phase, we collected auction data related to the identified parameters, including the number of total listings, the number of listings receiving at least one bid, the number of total bids, the average final price offered by bidders, and the auction fees charged to sellers. Last, in order to evaluate the hypotheses, a statistical t-test was performed to compare the mean differences of the average bids (H1) and the average final prices (H3) on the auction sites. To test H4, a z-test was performed on the proportional differences of the ratio identified in H2, simulating different starting price combinations to derive the auction fees which were subtracted from the average final price offered to arrive at the final value available to sellers.

Data were collected from eBay (http://www.ebay.com), using the feature of "completed listings" and from Yahoo! (http://auctions.shopping.yahoo.com/), using the feature of "advanced search by closed auctions" on Yahoo! We extracted the data of ended auctions with a keyword search. Only data from transactions starting and closing in the United States for the first two-week period of February, 2005, were included. To find out the average final price offered by buyers, we collected the following information: 1) the highest bid per item, regardless if the reserve price is met, or 2) the value set by the seller and matched by the buyer with "buy-it-now" (eBay) or "buy-price" (Yahoo!) options. With this information, we calculated the average final price offered by buyers. Then, we calculated the final value available to sellers by subtracting from the average final price offered by buyers, the "insertion fee," the "buy-it-now fee," and the "final value fee" (eBay) or the "listing fee" and "final value fee" (Yahoo!). Since we were interested in the average final price of bids, we did not isolate any sellers' strategies, such as "buy it now," "buy price," "low starting price," and "setting reserve price" in our analysis. Also, we include products with all conditions (new, refurbished, and used) trying to avoid sample size limitations for the statistical analysis.

Statistical analysis was conducted in the following way: Statistics t-tests were used to compare the "average bids per listing" and "average final price offered by the bidders" from the two sites; z-test were conducted to compare the ratio of "listings that received at least one bid" to "total listings" gathered from the two sites.

In the second stage of the project, the study aimed to have some insights on how e-auctioneers select action sites. This information is important to complement the study hypotheses. These hypotheses state that e-auctioneers will be willing to use the site that give them higher surplus, and that the auction site with higher fees is the one that offers the sellers higher selling prices. However, if e-auctioneers only know eBay, they will be using this site because this is the only virtual market that they know, disabling our claim that e-auctioneers prefer eBay because of a network externality phenomena. To find out how e-auctioneers select a site, we surveyed 93 Computer Information Systems senior students. The survey asked if they have buy-sell in eBay or Yahoo!, and given that they use eBay, why they do or do not use Yahoo!.

DATA COLLECTION

This section presents the data collected from the leading site and the competitor site during the first two weeks of February 2005. We excluded listings under US $100.00, which usually represents iPOD-related accessories. In addition to the e-auction results, this section includes the listing fees and final value fees charged by eBay and Yahoo! during the data collection period.

Auction Results

This research focused on the iPOD Mini and the iPOD Photo 40GB. eBay maintains a complete auction history for two weeks after the auction ends and provides an auction search tool called "completed listings." This tool allows users to search the desired ended auctions. Similarly, Yahoo! maintains auctions data for a longer period, which can be collected using the feature "advanced search by closed auctions."

The auction results in both sites are summarized in Table 1 and Table 2. Table 1 shows the results for the iPOD mini, while Table 2 presents the results for the iPOD Photo 40GB.

	eBay	Yahoo
Number of total listings (a)	1657	21
Listings receiving at least one bid (b)	1559	21
Ratio of (b) to (a)	0.9409	1
Total bids	29,340	46
Average bids received per listing	17.7067	2.1905
Standard deviation of bids per listing	13.8005	2.0147
Average final price offered by bidders($)	222.48	134
Standard deviation of average final price offered	26.1295	54.1860

Table 1. Auction Results of iPOD Mini on eBay and Yahoo!

	eBay	Yahoo
Number of total listings (a)	155	31
Listings receiving at least one bid (b)	141	31
Ratio of (b) to (a)	0.9097	1
Total bids	2,277	259
Average bids received per listing	14.6903	8.3548
Standard deviation of bids per listing	15.2707	6.4285
Average final price offered by bidders($)	423.0177	192.8300
Standard deviation of average final price offered	40.45901	50.57602

Table 2. Auction Results of iPOD Photo 40GB on eBay and Yahoo!

Fees Charged by Auction Sites

The basic charges imposed by auction sites are listing fees, final value fees, and the optional "buy-it-now" fee if sellers selected this feature. Auction sites provide different functions and auction features. The use of such special features allows sellers a huge variance in selling strategies. In order to focus on the fundamental factors, additional fees for special features such as "reserve price," "highlight," "bold," "gift icon," and "featured listing" were excluded from the study.

Both eBay and Yahoo charge a listing fee for every auction listed, whether or not the item is sold. The basic listing fee, the "insertion fee" on eBay and the "listing fee" on Yahoo, is charged according to the higher value of the starting bid price or the item reserve price. Such "listing fee," then, is a variable charge with a different value for each different price range. For instance, if a seller sets the starting price at $0.99 with no reserve price, eBay and Yahoo charge the seller $0.25 and $0.05 respectively; however, if the seller sets the starting price at $25, the listing fee charged by eBay and Yahoo will be $1.20 and $0.35 respectively. eBay may also charge a "buy-it-now" fee, in addition to "insertion fee" or "listing fee", when the seller selects this function during the listing process. Table 3 shows fees charged by the two auction sites.

When the item listed on the auction site is sold, the auction site charges the seller a "Final Value Fee." This fee, regarded as a commission for the auction sites, is a percentage of the average final price of any sold item, and it is part of the total auction fees charged by the auctioneer. The Final Value Fees charged by eBay and Yahoo are presented in Table 4.

Starting, Reserve Price, or Buy-it-now price	eBay		Yahoo Auction	
	Insertion Fee	**Buy-it-now price**	**Listing Fee**	**Buy Price Fee**
\$0.01 - \$0.99	\$0.25	0.05	\$0.05	0
\$1.00 - \$9.99	\$0.35			
\$10.00 - \$24.99	\$0.60	0.10	\$0.15	
\$25.00 - \$49.99	\$1.20	0.20	\$0.35	
\$50.00 - \$199.99	\$2.40	0.25	\$0.75	
\$200.00 - \$499.99	\$3.60			
\$500.00 or more	\$4.80			

Table 3. Auction Basic Listing Fee and Buy-it-now Fee

Closing Price	eBay Final Value Fee	Yahoo Final Value Fee
\$0.00 - \$25.00	5.25% of the closing value	2% of the closing value
\$25.01 - \$1,000.00	5.25% of the initial \$25.00 (\$1.31), plus 2.75% of the remaining balance	2% of the first \$25 (\$0.50) plus 1% of the remaining value
Over \$1,000.00	5.25% of the initial \$25.00 (\$1.31), plus 2.75% of the next \$975.00 (\$26.81), plus 1.50% of the remaining values	2% of the first \$25 (\$0.50) plus 1% of the next \$975.00 (\$9.75) plus 0.5% of the remaining value

Table 4. Auction Final Value Fee

Survey Results

Sixty Senior CIS students answered the survey. Fifteen students (25%) out of the 60 have never sold or bought with e-auctions. Consequently, we had 45 e-auctioneers in our sample. From this e-auctioneer population, 17%, eight students, buy and sell on both eBay and Yahoo! and 83%, 37 students, buy or sell on eBay but not on Yahoo!. The following reasons were given for not buying or selling on Yahoo!: They do no know that Yahoo! supports e-auctions, 23 students; cannot find the product the buyers are looking for, seven students; there are fewer suppliers, four students; there are fewer buyers, four students; the average final price on eBay is higher than on Yahoo!, one student; there are more risks on Yahoo!, two students; the user interface is more difficult to use, one student; and other reasons, six students.

ANALYSIS OF RESULTS

The statistical analysis used a t-test to compare the average bids per listing and the average final price offered by bidders. Also, a z-test was used to compare the ratio of "listings that receive at least one bid" to "total listings." It is worth mentioning that the auction fees were calculated by simulating combinations of different starting prices with the average final price offered by bidders. For example, if a seller sets the starting price at \$0.01 for an iPOD mini as listed and received an average final price of \$222.48 on eBay, this seller will have to pay \$0.25 as insertion fee and \$6.74 as final value fee. In the case of Yahoo!, however, for the same starting price and an average final price of \$134.00 received on Yahoo!, the seller would pay \$0.05 listing fee and \$1.59 final value fee. The final price available to sellers was calculated by subtracting the listing fee and the final value fee from the average final prices offered. Tables 5, 6, 7, and 8 present the statistical test for hypotheses H1, H2, H3, and H4 respectively.

t-test of two means (one-tail):	iPOD mini	iPOD Photo 40GB
Significant level (α)	0.01	0.01
P-value	0.0000	0.0001
t-critical	2.4033	2.3614
t-statistic	27.9480	3.761

*t-statistics > t-critical: null hypothesis shall be rejected

Table 5. The average number of bids placed on the market leader site is greater than on the competitor site (H1)

z-test of two proportions (one-tail):	iPOD mini	iPOD Photo 40GB
Significant level	0.01	0.01
P-value	0.0000	0.0000
z-critical	-2.3263	-2.3263
z-statistic	-10.2059	-3.9230

*z-statistic < z-critical: null hypothesis shall be rejected

Table 6. The ratio of "listings that receive at least one bid" to "total listings" is higher on the market leader site than on the competitor site (H2)

t-test of two means (one-tail):	iPOD mini	iPOD Photo 40GB
Significant level	0.01	0.01
P-value	0.0000	0.0000
t-critical	2.5280	2.4286
t-statistic	7.4710	23.7260

*t-statistics > t-critical: null hypothesis shall be rejected

Table 7. The average final price offered by the bidders is higher on the market leader site than on the competitor site (H3)

	Starting price	Insertion Fee/ Listing fee (A)	Buy-it-now fee* (optional) (B)	Average final price (C)	Final value fee (D)	Total auction fees ($) (E) = (A)+(B)+(D)	Final price available (C) – (E)	Differences (eBay – Yahoo)
iPOD Mini								
eBay	0.01 ~ 499.99	0.25 ~ 3.60	0 ~ 0.25	222.48	6.73	6.98 ~ 10.59	211.89 ~ 215.5	+80.23 ~ 83.14
Yahoo	0.01 ~ 499.99	0.05 ~ 0.75	0	134	1.59	1.64 ~ 2.34	131.66 ~ 132.36	
iPOD Photo								
eBay	0.01 ~ 499.99	0.25 ~ 3.60	0 ~ 0.25	423.02	12.25	12.50 ~ 16.1	406.92 ~ 410.52	+217.02 ~ 219.92
Yahoo	0.01 ~ 499.99	0.05 ~ 0.75	0	192.83	2.18	2.23 ~ 2.93	189.90 ~ 190.60	

*"Buy-it-now" fee is charged only when the seller selects to use the feature; for auction listing without this feature, the charge will be 0.

Table 8. After subtracting the fees charged by auction sites, the average final value available to seller is higher on the market leader's site than on the competitor's site (H4)

In the present research, hypotheses 1, 3, and 4 are supported, while hypothesis 2 was not supported (Table 9).

Hypothesis	Description	Supported	Not Supported
H1	The average number of bids is greater on market leader's site than on the competitor's site	a	
H2	The ratio of "listings that receive at least one bid" to "total listings" is higher on the market leader's site than on the competitor site.		a
H3	The average final price offered by the bidders is higher on the market leader's site than on the competitor's site.	a	
H4	After subtracting the fees charged by auction sites, the average final value available to sellers is higher on the market leader site than on the competitor site.	a	

Table 9. Summary of Results

The average number of bids is higher on eBay than on Yahoo!. In auctions, generally the more bids a product receives, the higher the final selling price for that product. Since eBay has a bigger buyer base, eBay can charge higher fees than its competitors and still attract more sellers to its site. This behavior is similar to the behavior of the leader in the market of spreadsheet software reported by Brynjolfsson and Kemerer (1996). In this case, the leader software manufacturer charged much more for the spreadsheet than its competitors and still kept the biggest part of the market.

The ratio of "listings that received at least one bid" to "total listings" is important for auctions because it increases the likelihood that the product is going to be sold. If no bid is placed, it means that no bidder is interested in the listing, limiting the selling options to zero. It appears that Yahoo! generates a higher ratio of "listings that received at least one bid" to "total listings" than eBay. This finding suggest that Yahoo! has a better opportunity to receive at least one bid for each listing because the market supply and competition is less intense on Yahoo!. Theoretically speaking, if the market supply is quite limited, the equilibrium price shall rise; however, in this study, the findings show a different result. In order to explain the phenomenon, we need to consider the market demand. The average number of bids received per listing is far smaller on Yahoo! than on eBay, and the average number of bids received per listing is a very strong indicator of market demand. Due to the comparatively weak market demand, the equilibrium price on Yahoo! is therefore brought down and can not provide a better chance for sellers to make greater profits.

The average final price offered and its standard deviation both suggest how much the buyers are willing to pay for the product, regardless of the bid being accepted by the seller. Sellers are willing to pay higher fees at eBay because of eBay's larger base of buyers. This larger buyer base translates into a higher number of bids and higher average final price for the item.

After subtracting the fees charged by auction sites, the average final value available to sellers is higher on the market leader's site than on the competitor's site. eBay seems to have a very strong advantage in retaining sellers on its platform. According to Brynjolfsson and Kemerer's (1996) findings, due to network externalities, the leader charges could be proportional to the size of its market share. eBay could charge substantially higher fees and still it could secure a higher final value for sellers.

Results Second Stage

The results of the survey show that the e-auction market is related to different groups of players. First, there is a group of people who have never use a virtual market to realize consumer-to-consumer transactions. Another group includes eBay users who do not know that Yahoo! also provides an e-auction site or they simply choose to overlook it. Then, there is a group formed by eBay users who prefers using eBay because of the network externalities of the market. For example, some responses state that "eBay is more popular," "already had an account with eBay and got no reason to open another one on Yahoo!," and "I am not interested on using Yahoo!" Last, another group of users realizes consumer-to-consumer transactions in both sites.

There are two findings of the survey that are relevant to this project. First, the fact that 48 percent of the e-auctioneers prefer to buy/sell on eBay because of the market network externalities support the hypotheses of this project. However, the results of the survey challenged the assumption that user prefer eBay over Yahoo! since a group of eBay users ignore that Yahoo! is an alternative for e-auctions. At the same time it can be said this group of eBay users is part of the network externalities of the e-auction market.

CONCLUSIONS AND LIMITATIONS

The results of this exploratory project show that eBay is more attractive to sellers with its high volume of transactions and greater final value on deals. The study shows that the market leader truly provides a better opportunity for sellers to extract more consumer surplus by selling goods for higher prices; even after subtracting the auction fees from the average final price offered by bidders, the market leader is still much more appealing to sellers than its competitor.

Because of sample limitations, we recommend that readers take the study results with caution. One of these limitations is that the sampling was not taken randomly. Our pre-selection of products and the data collection period generated two populations instead of samples, reducing the validity of the t-test. Trying to overcome this weakness we use a z-test, which is a stronger test for our data set, for the iPOD Photo 40G. The results of the z-test (Table 10) support our findings with the t-test. Unfortunately, the data set for the iPOD mini is too small for us to use a z-test for this product.

z-test of two proportions (one-tail):	iPOD mini	iPOD Photo 40GB
Significant level		0.01
P-value		0.0000
z-critical		2.326348
z-statistic		23.860

Table 10. The average final price offered by the bidders is higher on the market leader site than on the competitor site (H3)

The study should be expanded in several dimensions to increase its reliability. At least three factors are important to include before replicating the study: The data collection period, number of products, and shipping charges. Collecting auction results for two weeks is quite limited: such a short period could hide seasonal impacts on the product demand. Having only one product limits the ability to generalize of the results, so we propose having a mix of products to increase the validity of the results. Ignoring the shipping cost fails to account for an important factor for sellers and buyers. Sellers' strategies regarding shipping varied substantially. Some sellers lower the price of the product, but then they increase the shipping cost to increase or maintain their profit margin. Other sellers announce free shipping to present a more attractive price to buyers.

Research in virtual markets and electronic auctions is very promising. There is a need to develop models that can predict the behavior of sellers, buyers, and auctioneers. This model should be able to characterize different selling strategies and different levels of risk.

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